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Do patients with chronic low back pain benefit from attending Pilates classes after completing conventional physiotherapy treatment?

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ABSTRACT

Background: Pilates has been advocated to be of benefit for patients with low back pain (LBP). The aim of this study was to investigate the possible benefits of attending Pilates classes for patients who had completed standard physiotherapy treatment but still had some symptoms.

Methods: Ethical approval was obtained. All LBP patient charts (n=181) who had completed physiotherapy treatment in the participating hospital during a 6 month period were screened for study inclusion. 29 women (16%) were recruited into the study. Subjects were randomly allocated either to attendance at a one hour Pilates mat class consisting of modified Pilates exercises for 8 weeks (n=15) or no further intervention (n=14). Outcome measures were evaluated by a blinded assessor using Visual Analogue Scale (VAS) for pain, Roland Morris Disability Questionnaire for disability and Sahrmann Abdominal Test for lumbopelvic control before and after the 8 week intervention period.

Results: Statistical Package for the Social Sciences (SPSS) version 15.0 was used to analyse data. The Mann-Whitney U test was used to identify any significant changes between the groups. There was a statistical (p=0.047) but not clinically significant improvement in pain in the Pilates group (9.5mm mean change on VAS) compared to the control group (-4.7mm). No significant difference in disability was noted between the groups at follow up (p=0.301). A trend towards improvement in lumbopelvic control was observed in the Pilates group.

Conclusion: Despite the small sample size this study provides some evidence to support the use an 8 week Pilates class to improve pain in women with ongoing LBP who have completed conventional physiotherapy treatment.

Keywords: Psychosocial, paediatric, psychosomatic, yellow flags

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INTRODUCTION

It is estimated that up to 70 % of the adult population in the Western world will experience low back pain (LBP) at some point in their lives.¹ The majority of people who experience an episode of low back pain can expect symptoms to resolve within three months, nevertheless a sizeable proportion experience recurrences and some report continuous symptoms for many years.²

Several trials have shown that conventional physiotherapy treatment consisting of advice, exercise and manual therapy produces clinically significant improvements in pain and disability for patients with LBP.^{3,4} Though improved, a review of the outcome measures of these trials reveal many patients who complete physiotherapy treatment are not symptom free. Pilates has been advocated to be of benefit for patients with LBP and it has been reported that some physiotherapists now recommend Pilates in the treatment of their patients.^{5,6}

Pilates is a form of exercise therapy aimed at improving the alignment of the spine, awareness of breathing and strengthening the deep torso muscles.⁷ The Pilates mat exercises are undertaken in standing, supine, prone or side lying and use movements of the limbs to vary torque on trunk muscles. Particular emphasis is placed on posture and control and strengthening of the trunk and back muscles.⁸ Poor motor control and dysfunction of the deep stabilising muscles such

as transverses abdominus, the pelvic floor and multifidus have been reported to be associated with LBP,⁹ Pilates exercises aims to retrain these muscles.⁷

Some research evidence exists to support the use of Pilates in the management of patients with LBP. Studies have suggested Pilates to be as effective as 'Back School'¹⁰ and conventional physiotherapy¹¹ and better than a non treatment control group.^{12,13} However these studies had small sample sizes and nearly all recruited patients with low levels of pain and disability. Several different types of Pilates were used in these studies but all used modified Pilates exercises for subjects with LBP rather than the original high level classical Pilates exercises.

The trials conducted to date supply some evidence to support the use of modified Pilates mat exercises to improve pain and to a lesser degree disability in patients with LBP. To date no studies been published that investigate the benefits of Pilates classes for patients with LBP who have persistent symptoms after receiving standard physiotherapy treatment.

The objective of this study was to investigate if attendance at an 8 week Pilates mat based exercise class, after completing standard physiotherapy treatment, resulted in improvement in pain and disability for patients with chronic LBP.

METHODS

Design

This study was a single blinded randomised controlled trial that compared two groups, a treatment group which attended eight weeks of Pilates classes following conventional physiotherapy treatment to a control group which received no further intervention. Ethical approval for the study was received from Coventry University and the University College Cork ethics committees.

Sample

During the 6 month recruitment period, April to September 2008, the physiotherapy charts of 181 low back pain patients who had completed physiotherapy treatment in Cork University Hospital were screened by the chief investigator (KQ). To be included in the study participants had to be aged between 18-60 years, have chronic LBP (> 3 months duration) with no pain radiating below the knee and be willing to attend Pilates classes for 8 weeks. Subjects also had to have some residual pain (VAS >18mm) and have failed the Sahrman Abdominal Test for core stability. Participants were excluded if they suffered from a significant other co-morbidity such as unstable cardiovascular system, uncontrolled epilepsy, Modified Zung Depression Index score >33/69¹⁴ or significant pain in other joints which would affect their ability to participate in class. Subjects were also excluded if they were pregnant, had spinal surgery in the past 12 months or were diagnosed with significant disc prolapse on MRI, severe scoliosis, inflammatory low back pain or had high level of disability (Roland Morris Disability Questionnaire <16/24). 29 patients were recruited into the study.

Procedure

Following the review of patients' charts eligible patients who expressed an interest in participating in the trial were given an appointment with the principal investigator and informed consent was obtained from subjects who agreed to participate in the study. Further screening of inclusion and exclusion criteria and demographic details were recorded, including age, sex, duration of LBP and Body Mass Index (BMI) and a note was made of any painful or restricted lumbar or other joint movements.

The study design did not permit blinding of the participants or the treating physiotherapist. However baseline and final outcome measures of subjects participating in the study were recorded at a separate appointment by another physiotherapist (LB) who was blinded to group allocation and was not involved in providing treatment.

Randomisation and concealed allocation was carried out using sequentially numbered, opaque sealed envelopes.¹⁵

Subjects in the intervention group attended weekly, hour long Pilates classes for eight weeks. Attendance at least 6 out of 8 sessions was required to be defined as completing the intervention.

The class consisted of modified mat based Pilates exercises and was based on a Body Control Pilates exercise program used by a previous study.^{11,16} Full details of the Pilates class structure used are available from the author.

All classes were run by the chief investigator who was a chartered physiotherapist and a qualified Body Control Pilates

instructor. Class size was limited to six to ensure close supervision of the participants. During the study class size varied from three to six participants in the different Pilates class groups. The Pilates instructor provided physical assistance and verbal feedback to maximise accuracy as well as safety during the exercises. Participants were advised not to work through pain or discomfort. Exercises were modified for the individual participants if they had increased pain with any exercises or had significant difficulty controlling an exercise. The instructor was aware of any painful limitations of lumbar movements from the initial screening appointment completed with all subjects prior to commencing the study. Subjects in the intervention group were also advised to complete 15 minutes of Pilates exercise five days of the week at home. Compliance with home based exercise was monitored by a self-recorded diary.

Subjects in the control group received no further intervention for the eight week period. After completing the eight week follow up assessment, patients in the control group were given the option of attending the same Pilates course as the intervention group had completed.

OUTCOME MEASURES

Pain

A visual analogue scale (VAS) was used to evaluate pain symptoms. It consists of a 100mm long horizontal line with the wording "No pain" at one end and "Pain as bad as it possibly could be" at the other end.¹⁷ The possible score varies from 0 to 100mm. The VAS is reported to be a reliable outcome measure for pain evaluation.¹⁸ It has also been shown to be sensitive to change and have high validity in terms of outcome measures when used to measure pain intensity.¹⁹ An 18mm change on the VAS represents clinically meaningful change in patients with chronic low back pain.²⁰

Disability

Disability was measured with the Roland Morris Disability Questionnaire (RMDQ).²¹ The RMDQ consists of a self reported perceived disability 24 item questionnaire which covers a range of activities which may be affected by LBP. Each statement that is ticked is worth one point with the maximum score '24' representing severe disability and the lowest score possible '0' representing no disability. The RMDQ has been shown to have acceptable level of reliability and validity in the measurement of disability in patients with chronic LBP.^{22,23}

Lumbopelvic control

The Sahrman Abdominal Test (SAT) was used to assess lumbopelvic control. This test is undertaken in crook lying with a pressure biofeedback unit (PBU) [Chattanooga Group, Inc] inflated to 40mmHG placed under the lumbar spine of the subject. The subject lifts one foot off the floor raising the hip to 90deg flexion and is requested to keep the lumbar spine stable during movement of the leg (Figure 1). The subject is deemed to have failed the SAT test if pressure reading on the PBU increases by more than 2 mmHg during the upward movement of the leg. The SAT testing procedure was based on method described by Roussel.²⁴

The SAT has been shown to have good inter-observer reliability in low back pain patients.²⁵ The Sahrman

abdominal test is reported to be a clinically useful test as results of the test differ significantly between LBP patients and healthy controls ($p < 0.01$), with more LBP patients failing the test.²⁵ However the validity of this test has not been established. A valid measure of lumbopelvic control has not yet been identified in the literature.³

Figure 1: SAT test



Data analysis

Statistical Package for the Social Sciences (SPSS) version 15.0 was used to analyse data. Statistical significance was set at $p < 0.05$. Descriptive statistics were used to present the baseline characteristics of participants. The baseline demographics were assessed for statistically significant differences between the two groups using unrelated t-test for interval level data with a normal distributions or Mann-Whitney U for ordinal data. The Mann-Whitney U test was used to identify any significant changes between the groups in pain and disability pre and post intervention.

The data from the SAT test consisted of numbers of subjects passing or failing the test in each group and initially the Chi-squared test was selected to assess for difference between the two groups. However the required assumptions for the Chi-squared test were not met so data has been presented as percentage values.

Groups were analysed on an intention to treat basis. All subjects were included to avoid bias by omitting non compliers. Last known values were carried forward to replace missing values for any subjects who failed to attend for final assessment.²⁶

RESULTS

Subjects

Patients whose charts did not contain reference to any of the specified exclusion criteria were contacted by the researcher regarding participation in the trial ($n=59$). Of those contacted and provided with information 17 declined to participate. The remaining 42 subjects attended for further screening and baseline assessment. Only 29 subjects were recruited into the study. The reasons for exclusion of all other patients are listed in Table 1.

Table 1: Reasons for exclusion from study

	Total [n=152] (100%)	Women [n=111]	Men [n=41]
LBP < 3/12 duration	16 (11%)	12	4
Zung >33/69	4 (2%)	4	0
Pain VAS <18mm	30 (19%)	27	3
RMDQ >16/24	10 (7%)	7	3
Spinal surgery previous 12 months	17 (11%)	9	8
AS/ disc prolapse/ spinal fracture	22 (15%)	15	7
Pain referred distal to knee	20 (13%)	15	5
SLR <50deg	3 (2%)	2	1
Pregnant	2 (1%)	2	-
Declined	17 (11%)	7	10
Over 60 years	5 (3%)	5	0
Limited understanding English	3 (2%)	3	0
Passed SAT test	3 (2%)	3	-

The mean (SD) age of the population included in the study was 43 years (13.02) and ranged from 21-60 yrs. The mean (SD) duration of LBP was 4.5years (3.64) and ranged from 6 months to 15 years. The mean (SD) baseline level of pain VAS scores for the total group was 40.2mm (17.1) and the mean (SD) baseline level of disability measured on the RMDQ was 7.28 (4.71). A summary of the baseline characteristics and variables of the treatment and control groups is provided in Table 2. There was no significant difference in the groups characteristic and key variables at baseline ($p < 0.05$).

Table 2: Baseline characteristics of participants
Values given are means (standard deviation).

Variable	Treatment Group (N=15)	Control Group (N=14)	P value
Age in years	41.8 (13.84)	44.07 (12.50)	0.647~
Duration LBP in years	4.82 (3.20)	4.13 (4.15)	0.253~~
Zung Index [0-69]	21.2 (8.67)	14.79 (8.23)	0.070~~
BMI	25.78 (4.90)	24.57 (3.83)	0.468~
Initial RMDQ [0-24]	6.87 (4.57)	7.71 (4.98)	0.646~~
Initial VAS [0-100mm]	40.43 (14.6)	39.9 (19.9)	0.938~

Figures in square brackets [] represent range of available scores for that measure

~Unrelated t test

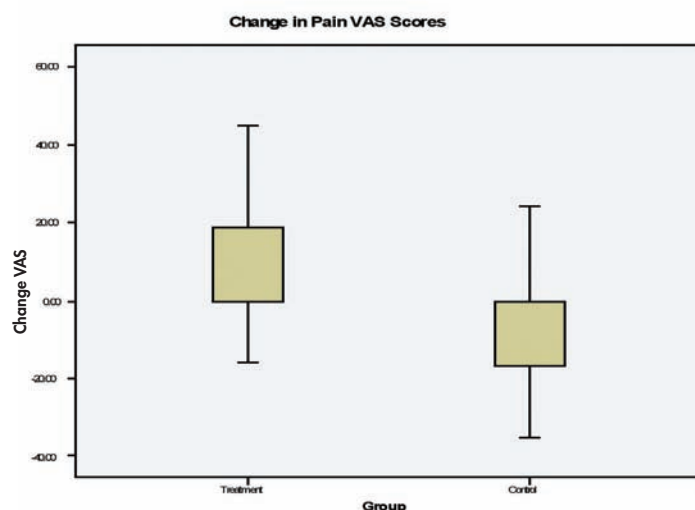
~~Mann-Whitney U test

Of the 15 subjects allocated to the treatment group, 10 (66%) attended more than six of the eight Pilates classes and were deemed to have completed the treatment intervention. All five subjects who did not complete the intervention were followed up to establish reasons for non-compliance. One was unable to attend classes because of ill health of a close family member. Another subject injured her knee in a fall outside the class and was unable to participate in the mat exercises. Two subjects were unable to attend because of a change in their work schedules which coincided with class times. One participant withdrew from the class because she preferred to attend for massage rather than the Pilates classes for ongoing management of her LBP. None of the five subjects who dropped out of the classes cited an increase in LBP as their reason for nonparticipation in the classes. Of the 14 subjects allocated to the control group, 10 (71%) returned for the follow up assessment at eight weeks.

Pain

An improvement of 9.5mm (range -16 to 45mm) was noted in mean VAS pain scores for treatment group at follow up review after the classes. The mean VAS scores for the non-treatment control group deteriorated slightly by 4.7mm (range -35 to 24mm) over the same time period. There was a statistical significant difference in pain between the two groups ($p=0.047$).

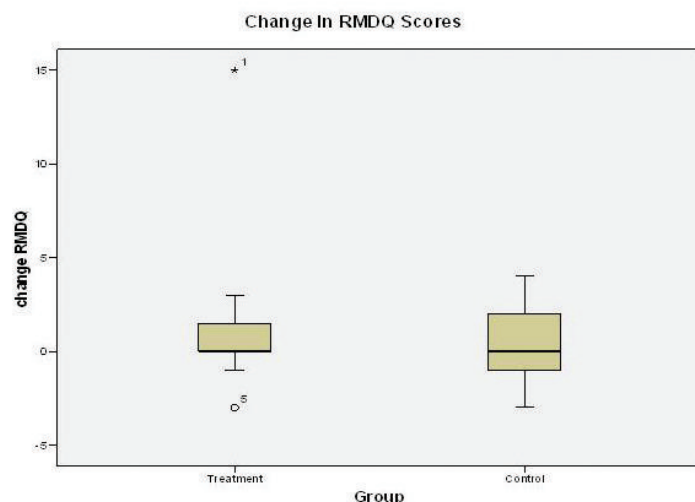
Figure 2:



Disability

The mean scores of the RMDQ improved slightly in treatment group from an initial mean score of 6.87 to final mean score of 5.40. This improvement of 1.47 was greater than the improvement of 0.21 seen in the control group but failed to reach a statistically significant level ($p=0.301$).

Figure 3:



Lumbopelvic control

All of the subjects participating in the trial had failed the SAT on initial assessment as this was one of the inclusion criteria for the trial. On final review four of the ten participants (40%) who completed the classes passed the SAT test. However analysis was done on an intention to treat basis so the overall pass rate for the treatment group was 27%. None of the control group passed the SAT test on follow up review.

Completed home exercise diaries were returned by 7 (70%) of the 10 subjects who completed the classes. A review of the diaries returned showed a high level of reported compliance with the practice of exercises at home.

DISCUSSION

The results of this study provide some evidence to support the use of an eight week mat based Pilates class to improve pain

in patients who have completed conventional physiotherapy. The change in VAS scores of the treatment group compared to the control group reached a statistically significant result ($p=0.047$). However the mean change in VAS score from baseline to final review of the Pilates group was 9.5mm. This is less the 18mm reported to be the minimum change required in patients with LBP to represent clinically significant change in their pain symptoms.²⁰ Similar to another study investigating the effectiveness of Pilates for chronic LBP patients,¹² the current trial revealed only a statistically significant and not a clinically significant reduction in pain.

Only one existing study showed clinically and statistically significant improvements in pain and disability in the Pilates group compared to a control group.¹¹ This trial looked at patients with sub-acute LBP rather than chronic LBP. It may be that eight weeks of Pilates intervention is more effective for patients with sub-acute LBP. Perhaps classes run over a longer period of time would be required for patients with more chronic symptoms.

There was no statistical or clinically significant change in disability as measured by the RMDQ in the Pilates group in the current study. This finding is reflective of several other studies conducted which also failed to show a clinically significant improvement in disability in the Pilates treatment group of patients with chronic LBP.^{10,12,27} Therefore, to date little evidence exists to support the use of Pilates to improve disability in chronic LBP patients.

The results of the SAT test may provide some evidence to support the use of Pilates to improve lumbopelvic control in chronic LBP patients as 40% of those patients who completed the classes passed the test at final review. Including compliers and non compliers in the treatment group the pass rate of 27% was greater than 0% in the control group.

The importance of not treating all chronic mechanical LBP patients as a homogenous group has been highlighted by several authors.^{28,29} Patients with chronic mechanical LBP are unlikely to respond to one type of intervention therefore the sub-classification of this patient group has become a key issue for health professionals offering care to LBP sufferers.³⁰ Pilates is a form of core stability training which aims at increasing the ability of the deep trunk muscles to support normal trunk and limb movements.³¹ This type of intervention would be most suitable for LBP patients with reduced control of lumbopelvic movements or core strength. Core strength has been defined as the muscular control required around the lumbar spine to maintain functional stability.³² Only one of the previous trials conducted aimed to measure improvement in lumbopelvic motor control.¹¹

All the subjects included in this study had failed the SAT test which is proposed to assess lumbopelvic control.²⁵ A previous study reported a significant difference between LBP patients and people with no history of LBP in this test.²⁵ The aim of using this test was to include only LBP patients who had reduced lumbopelvic control and to utilise this test to evaluate if any change in lumbopelvic control was observed before and after the intervention period in each group. However, only three patients of the 42 tested were excluded for passing this test. No gold standard exists for measuring lumbopelvic control.³

A number of possibilities may be considered in relation to

this. First, it is possible that nearly all LBP patients tested had reduced lumbopelvic control as indicated by the SAT test. Second, it is possible that the SAT test may not be a valid test of lumbopelvic control. In either case it seems unlikely the SAT identified a specific subset of LBP patients in this study with reduced lumbopelvic control. This trial population should be considered to have consisted of non-specific chronic LBP patients.

The mechanisms by which the Pilates method may achieve improvements in pain for LBP patients have not been established.³³ Pilates exercises aim to improve the alignment of the spine, awareness of breathing and improve strength and control of the trunk muscles.³⁴ Poor motor control and dysfunction of the deep stabilising muscles such as transverses abdominus, pelvic floor and multifidus have been reported to be associated with LBP.⁹ Pilates is proposed to incorporate aspects of retraining these muscles into its method.⁷ However no studies to date have proven that Pilates exercises improve control of Transversus abdominus or other deep stabilising muscles in LBP patients. The current study may provide some evidence that Pilates can improve lumbopelvic control in this patient group. However further research into the validity of the SAT test as a measure of lumbopelvic control is required to support this finding. Pilates also incorporates the principle of concentration and also a focus on breathing and relaxation and these mental aspects of the method may play a role in its mechanism of action with chronic LBP patients.³³

The results of this study can only be applied to a similar population. In a recent descriptive study of 327 subjects attending Pilates classes in the community, women accounted for 81% of the sample.³⁵ The mean age of the sample in the descriptive study was 42 years (SD 13.27) which led the authors to conclude that the majority of people seeking Pilates in their sample were middle aged women. It is interesting to note that the study population in the current study bore marked similarity to the self selected group in the descriptive study with a near identical mean age and entire bias towards female subjects.

Unlike any other studies investigating the effectiveness of Pilates for LBP, all patients in this trial had recently completed a course of physiotherapy. All subjects recruited into this study had received conventional physiotherapy intervention as described in the UK Chartered Society of Physiotherapy (CSP) clinical guidelines for the physiotherapy management of persistent LBP.³¹ This study did not look at the baseline levels of pain and disability prior to the physiotherapy treatment and was only concerned with assessing the possible benefits of attending an eight week Pilates class, in terms of improving pain and disability in patients with some ongoing symptoms after completing standard physiotherapy.

The Pilates class structure in this trial consisted of a modified program and was designed for participants with low back pain. This is reflective of the structure of the Pilates intervention in other trials evaluating Pilates for LBP. In other trials conducted it was noted that most subjects did not get past the very beginning phases of Pilates.^{10,27} A recent review of Pilates for LBP also emphasised the importance of the structure of the Pilates classes utilised with this patient group and highlighted that the Pilates exercises used for

patients with LBP differ from the original higher level classical Pilates mat exercises.³⁶ This should be borne in mind by instructors providing classes and by clinicians recommending Pilates for LBP. A class aimed at a normal asymptomatic population may differ significantly from the class content used in the studies investigating the benefits of Pilates for LBP. There is some variety in the exercises used in the different studies however all used modified or basic Pilates exercises that were progressed as patients' control improved.

This study was undertaken using small numbers in a class setting and with close supervision by a Body Control Pilates instructor who was also a chartered physiotherapist. In most of the studies conducted on the effectiveness of Pilates for the treatment of LBP, the Pilates instructors who taught the Pilates exercises were also qualified physiotherapists.^{10,11,13} Therefore the results of these studies cannot be generalised to Pilates classes run in the community by qualified Pilates instructors only. One study, where the teacher of the Pilates group was described as a certified Pilates Institute instructor, provides some support for Pilates instructors without a physiotherapy qualification working with this patient group.¹² Of note, the participants in that trial had very low baseline levels of pain and disability.

CONCLUSIONS

This study provides some evidence to support the use of an eight week Pilates class to improve pain in women with ongoing symptoms who have completed conventional physiotherapy treatment. No evidence was found to support the use of Pilates in this group to reduce disability as measured by the RMDQ. The results of this trial also suggest that attendance at an eight week Pilates class may result in improvements in lumbopelvic control as measured by the SAT. The results of this study cannot be generalised to all Pilates classes in the community. In particular the exercises utilised in this trial consisted of modified Pilates rather than classical Pilates exercises. The small class size of size of six or less also offered a high level of supervision by the Pilates instructor who was also a qualified chartered Physiotherapist.

Consensus exists in the studies conducted to date that modified Pilates exercises are more appropriate for LBP patients than classical Pilates exercises. However a variety of modified Pilates exercises programs have been used and further studies are required to evaluate the benefits of different modified Pilates regimes. Further studies are also needed to identify the optimum frequency, duration and size of Pilates classes for chronic LBP patients.

All studies undertaken to date have consisted of relatively small sample sizes. Larger scale trials involving more than one instructor or centre are required.

Research into the mechanisms of action of Pilates in LBP patients is also warranted, including the effects of Pilates training on Transversus Abdominus, the pelvic floor and lumbopelvic control.

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APPENDIX A

Pilates Class Plan

All exercises used in the class plan are described in detail in The Body Control Pilates Manual (Robinson, Fisher and Knox 2000).

Week one

Educate re basic principles Pilates: alignment, concentration, breathing, centring, stabilisation muscles and coordination
Lateral thoracic breathing, compass and finding neutral spine position

Transversus abdominus and pelvic floor contraction in crook and side lying

Leg slide, knee fold and knee drops

Shoulder drops, Ribcage closure with arm opening, starfish

Diamond press, Dart beginning

Oyster,

Standing alignment

Week two

Relaxation position, core stabilisation, pelvic clock

Knee drop, leg slide, knee fold and knee stirs

Ribcage closure, shoulder drops, starfish

Spine curl

Diamond, dart

Cat, rest position, oyster

Toe rises in standing

Week three

Shoulder shrugs, side bend, Cossack in standing

Core stabilisation with breathing in relaxation position

Knee drops, knee folds, knee stirs, starfish, spine curl with arms, side rolls

Diamond press, dart,

Cat, oyster, arm opening, toe raises, knee bends

Week four

Cossack, side bends in standing

Arm and knee drops, windows, spine curl with arm raises, curl up,

Knee drops, knee stirs, single knee folds,

Diamond press, dart, cat, oyster, side lying leg lift, toe raises

Week five

Cossack, side bends

Ribcage closure, starfish, knee drop, single knee fold, knee stirs,

Spine curl with arm raises, curl up, spine curl into curl up

Diamond press, dart, cat,

Oyster

Table top leg extensions, cat, rest position

Shoulder shrug, toe raise, knee bends

Week six

Toe raise into knee bend, knee bend into toe raises, corkscrew

Arm and knee drops, knee stirs, single knee fold, starfish,

Neck rolls and spirals, curl up

Spine curl with arm raises, spine curl into curl up, double knee

fold, hundred stage two, Diamond, dart, abductor lift, arm opening

Week seven

Toe raise into knee bend, knee bend into toe raises, floating arms, corkscrew,
Single knee drop, single knee fold, Knee stirs
Double knee and arm drops, shoulder drops, curl up, oblique curl up, spine curl, spine curl into one hundred stage two, neck rolls,
Hamstring stretch with band, hip flexor stretch, double knee folds,
Oyster, abductor lifts and circles,
Cat, table top leg extension

Week eight

Toe raises into knee bends, knee bend into toe raises, dumb waiter into floating arms, Corkscrew,
Knee drop, Knee fold, Knee stirs,
Neck rolls, hip flexor stretch, hamstring stretch with band, spine curl with arm raises, spine curl into curl up, one hundred stage two, starfish,
Dart, diamond press
Oyster, abductor lift and circles,
Cat, table top leg extension, rest position.

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